a horizontal width, wherein each flow channel is connected to an inlet channel and an outlet channel, wherein the inlet channel and the outlet channel extend from the flow channel to the exterior of the manifold body;

the manifold body further comprising two or more holes extending downward from the top surface into the manifold body, wherein each of said holes intersects the horizontal section of one flow channel,

wherein each flow channel is configured so that fluid moving from the inlet channel through the horizontal section of the flow channel toward the outlet channel must pass through the portion of the flow channel that intersects at least one of the holes extending downward from the top surface of the manifold body; and wherein, optionally, the width of each hole where it intersects the flow channel is greater than the horizontal width of the flow channel at the point where the hole and flow channel intersect by a small amount.

2. The fluidic device of claim **1**, wherein the holes that extend downward from the top surface into the manifold body are circular in horizontal cross section.

3. The fluidic device of any one of the preceding claims, wherein the two or more holes that extend downward from the top surface into the manifold body are sized and positioned to receive the wells of a multi-well cell culture plate.

4. The fluidic device of claim **3**, which further comprises a sealing surface associated with each of said holes, wherein said sealing surface is configured to form a liquid-tight seal between a surface of the manifold body and an outer surface of each well of a multi-well cell culture plate when the multi-well cell culture plate is fitted to the top surface of the manifold body with the wells of the multi-well cell culture plate inserted into the holes that extend downward from the top surface into the manifold body.

5. The fluidic device of claim **4**, wherein the sealing surface is a sleeve or an O-ring positioned inside each of the holes that extend downward from the top surface into the manifold body.

6. The fluidic device of claim **3**, wherein an inlet channel or outlet channel for each flow channel extends upward from one end of the flow channel to open at the top surface of the manifold body.

7. The fluidic device of claim **3**, wherein the holes that extend downward from the top surface into the manifold body are uniform in size and each hole is shaped as a right cylinder having a vertical central axis that is aligned with the midline of the horizontal section of the flow channel the hole intersects.

8. The fluidic device of claim **7**, wherein the diameter of each of the holes is greater than or equal to the horizontal width of the flow channel where the hole intersects the flow channel so that the outer surface of the wells that are to be inserted into the holes when a multi-well cell culture plate is fitted to the top surface of the manifold body will extend beyond the flow channel and the bottom edge of the wells extends slightly over the top of the edges that define the flow channel.

9. The fluidic device of claim **7**, wherein at least two of the holes that extend downward into the manifold body intersect with a single flow channel.

10. The fluidic device of claim **3**, having a multi-well cell culture plate fitted to the upper surface of the manifold body so that each well of the multi-well cell culture plate is inserted into one of the holes in the top surface of the manifold body;

wherein at least one flow channel is configured to provide substantially uniform shear stress across the bottom surface of a well of the multi-well cell culture plate that is fitted to the top surface of the manifold body.

11. The fluidic device of claim **1**, wherein the manifold body is a two-piece manifold body, which comprises an upper portion and a lower portion, wherein the upper portion has a substantially flat lower surface that is parallel to the horizontal top surface of the manifold body; and the lower portion has a substantially flat upper surface having canals formed therein, wherein the lower surface of the upper portion forms a ceiling over the canals when the upper portion and lower portion are assembled by being pressed together, and optionally having a gasket sandwiched between the upper portion and lower portion to provide a fluid-tight seal between the two portions, and optionally having the upper portion and lower portion glued together, to form an assembled manifold body, so that the canals in the upper surface of the lower portion taken together with the lower surface of the upper portion form the flow channels in the assembled manifold body.

12. The fluidic device of claim **1**, further comprising a flexible membrane applied to a surface of the manifold body covering the openings of the outlet channels, wherein the flexible membrane forms a fluid-tight seal with the manifold body across each of the openings of the outlet channels, or wherein the manifold body comprises a groove around at least one of the outlet channel openings in the bottom surface of the manifold body, wherein each said groove is configured to hold an O-ring that is positioned to form a seal between the manifold body and the surface below it when the fluidic device is assembled, such as the flexible membrane when the manifold body is placed on a flexible membrane.

13. The fluidic device of claim **12**, further comprising living cells adhered to a porous membrane that forms the bottom of a well of the multi-well cell culture plate.

14. A system for exposing living cells to fluid shear stress, which comprises a fluidic device according to claim **1**; a multi-well cell culture plate configured for use with the fluidic device; and means to cause fluid inside the horizontal section of the flow channel of the fluidic device to move.

15. The system of claim **14**, wherein living cells are adhered to the underside of the porous membrane of the wells of the multi-well cell culture plate.

16. A method to apply shear stress to a living cell, which comprises adhering living cells to the bottom surface of a well of a multi-well cell culture plate, and fitting the multi-well cell culture plate to the top surface of the fluidic device of claim **1**.

17. A device to expose living cells to fluid shear stress, wherein the device comprises:

a plurality of wells having generally vertical walls and a generally horizontal floor, wherein at least a portion of the floor is a permeable membrane;

at least one flow channel positioned below the wells so that the permeable membrane portion of the floor of each well separates the well from one of the at least one flow channels;

an inlet that connects the flow channel to the exterior of the device, and an outlet that connects the flow channel